REMARKS

In response to the Office Action dated September 21, 2004, Applicants respectfully request reconsideration.

Amendments to the Specification

Page 7-8 bridging paragraph stands objected to by the Examiner. Applicants have amended the appropriate paragraph beginning on page 7, line 15 of the specification. As noted by the Examiner, the passage describes in overview the computation of elastic modulus E found on page 11 lines 10-24. No new matter has been introduced through this amendment.

The phraseology on page 10 line 2 stands objected to by the Examiner. Applicants have amended the appropriate paragraph beginning on page 8, line 27 of the specification. The amendment replaces the term "matching" with the synonym "comparing." No new matter has been introduced through this amendment.

Amendments to the Drawings

The drawings stand objected to by the Examiner as indicated on the Office Action Summary page. The Examiner, however, does not otherwise address the objection in the Office Action details. Accordingly, Applicants are unable to determine the nature of the objection and respectfully request clarification.

Claim Rejections - 35 USC § 102

Claims 1-5, 7-12, and 14-16 stand rejected under 35 U.S.C. 102(b) as being anticipated by US Patent No. 5,827,204 (Grandia). Applicants respectfully assert that these claims are patentable over Grandia.

Regarding independent claim 1, Grandia does not teach, disclose, or suggest a method to induce vibration of a desired region by providing a pushing force to a desired region. Grandia discusses a transmitter for exciting a multifrequency ultrasound wave for causing vaporous cavitation bubbles in a small focal zone (Abstract). Mechanical vibration is a result of imploding cavitations (Col. 3 line 2 cited by the Examiner). Claim 1, however, recites a method including transmitting first and second focused ultrasound energy beams from first and second sources into

an object such that the focused energy beam intersect at a desired region to induce vibrations of the desired region by providing a pushing force to the desired region. Thus, claim 1 recites vibrations that result from the pushing force of the ultrasound transducers, rather than the cavitation discussed in Grandia. For at least these reasons, applicants respectfully assert that claim 1, and claims 2-5 and claim 7 that each depend directly or indirectly from claim 1, are patentable over Grandia.

Regarding independent claim 8, Grandia does not teach, disclose, or suggest a system configured to induce vibration of a desired region by a pushing force provided by transmitted ultrasound energy. Grandia discusses mechanical vibrations that result from the imploding cavitations caused by ultrasound transmitters. Claim 8, however, recites a system configured to analyze ultrasound pulse echo signals to determine at least one of amplitude, phase and frequency of vibration induced in the desired region by a pushing force provided by transmitted ultrasound energy. Therefore, claim 8 is distinguishable from Grandia because claim 8 recites vibrations that result from the pushing force of the ultrasound transducers, rather then the cavitation discussed in Grandia. For at least these reasons, applicants respectfully assert that claim 8, and claims 9-12 that each depend directly or indirectly from claim 8, are patentable over Grandia.

Regarding independent claim 14, Grandia does not teach, disclose, or suggest a system including focused ultrasound energy to provide a pushing force to induce vibration of a desired region. Grandia discusses mechanical vibrations that result from the imploding cavitation caused by ultrasound transmitters. Claim 14, however, recites a system of determining elasticity of a desired region including first and second ultrasound transducers configured to convert electrical signals into focused ultrasound energy and to transmit the focused ultrasound energy to provide a pushing force to induce vibration of the desired region. Thus, claim 14 recites vibrations that result from the pushing force of the ultrasound transducers, rather than the cavitation discussed in Grandia. For at least these reasons, applicants respectfully assert that claim 14, and claims 15-16 that each depend directly or indirectly from claim 14, are patentable over Grandia.

Claims 1-6 stand rejected under 35 U.S.C. 102(b) as being anticipated by US Patent No. 6,068,597 (Lin). Applicants respectfully assert that these claims are patentable over Lin.

Regarding claim 1, Lin does not teach, disclose, or suggest a method including transmitting focused ultrasound energy beams to induce vibrations in a desired region. Lin discusses a system for characterizing and imaging the vibrational resonance properties of biological tissues with power Doppler ultrasound (Col. 1 lines 6-9). Audio transducers are placed on the skin to send continuous vibrational waves into the body to stimulate a vibrational response in embedded tissue (Col. 6 lines 21-23). The audio transducers operate in a frequency range of 10 Hz to 350 Hz (Col. 4 lines 67). Claim 1, however, recites a method including transmitting first and second focused ultrasound energy beams from first and second sources into the object such that the focused ultrasound beams intersect at the desired region to induce vibration of the desired region by providing a pushing force. The signals discussed by Lin are not of ultrasound frequency as recited in claim 1 and are not focused beams as recited in claim 1. Therefore claim 1 is not anticipated by, or obvious in view of, Lin. For at least these reasons, applicants respectfully assert that claim 1, and claims 2-6 that depend directly or indirectly from claim 1, are patentable over Lin.

Claims 1-5, 14-15 stand rejected under 35 U.S.C. 102(b) as being anticipated by US Patent No. 5,903,516 (Greenleaf) and US Patent No. 5,592,082 (Ehman). Applicants respectfully assert that these claims are patentable over Greenleaf and Ehman.

Regarding independent claim 1, Greenleaf and Ehman do not teach, disclose, or suggest a method including receiving an echo signal from a desired region indicative of reflected energy from a third ultrasound source. Greenleaf and Ehman in combination discuss a system including two ultrasonic transducers to impart a radiation force on a target (Greenleaf Col. 9 lines 35-40), and a magnetic resonance imaging ("MRI") system to measure the motion resulting from the radiation force in gyromagnetic materials such as tissue (Greenleaf Col. 10 lines 1-2, Ehman Col. 5 line 2). Thus, the MRI system uses nuclear magnetic resonance methods to measure the motion resulting from the radiation force. Claim 1, however, recites receiving an echo from the desired region indicative of reflected energy from a third focused ultrasound energy beam. For at least these reasons, applicants respectfully assert that claim 1, and claims 2-5 that each depend directly or indirectly from claim 1, are patentable over the combination of Greenleaf and Ehman.

Regarding independent claim 14, Greenleaf and Ehman do not teach, disclose, or suggest a system including means for receiving reflected ultrasound energy from the desired region and

determining the elasticity of the desired region. Greenleaf and Ehman in combination discuss a system including two ultrasonic transducers to impart a radiation force on a target (Greenleaf Col. 9 lines 35-40), and a magnetic resonance imaging ("MRI") system to measure the motion resulting from the radiation force in gyromagnetic materials such as tissue (Greenleaf Col. 10 lines 1-2, Ehman Col. 5 line. 2). Thus, the MRI system uses nuclear magnetic resonance methods to measure the motion resulting from the radiation force. Claim 14, however, recites a means for providing ultrasound energy to, and receiving reflected ultrasound energy from, the desired region and determining the elasticity of the desired region, based on the received reflected ultrasound energy. For at least these reasons, applicants respectfully assert that claim 14, and claim 15 that depends directly from claim 14, are patentable over the combination of Greenleaf and Ehman.

Claims 1-2 stand further rejected under 35 U.S.C. 102(b) as being anticipated by Ehman. Applicants respectfully assert that these claims are patentable over Ehman.

Regarding independent claim 1, Ehman does not teach, disclose, or suggest a method including receiving an echo signal from a desired region indicative of reflected energy from a third ultrasound source. Ehman discusses using a nuclear magnetic resonance imaging system to obtain a strain image pattern associated with an acoustic array (col 15 ln 41-45). Claim 1, however, recites receiving an echo from the desired region indicative of reflected energy from a third focused ultrasound energy beam. For at least these reasons, applicants respectfully assert that claim 1, and claim 2 that depends directly from claim 1, are patentable over Ehman.

Claim Rejections - 35 USC § 103

Claims 3, 10 and 14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Grandia as applied to claims 2 and 9 above, and further in view of U.S. Patent No. 5,501,655 (Rolt). Applicants respectfully assert that these claims are patentable over Grandia and Rolt. The Examiner does not assert that Rolt makes up for the deficiencies of Grandia noted above with respect to claims 1, 8 and 14. Thus, claims 3 and 10, that depend indirectly from independent claims 1 and 8 respectively, and independent claim 14, are patentable over Grandia in view of Rolt for at least the reasons discussed above with respect to independent claims 1, 8 and 14.

Claims 1-5, 7-12 and 14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,903,516 (Greenleaf) and U.S. Patent No. 5,592,085 (Ehman) further in view of U.S. Patent No. 4,566,460 (Sato) and U.S. Patent No. 4,510,255 (Shimura). Applicants respectfully assert that the proposed combination of Greenleaf, Ehman, Sato, and Shimura is improper, and therefore these claims are patentable over Greenleaf and Ehman in view of Sato and Shimura.

Applicants respectfully assert that Sato does not teach, disclose, or suggest at least the recited focused ultrasound to induce and measure vibrations. Sato discusses a pumping wave to induce pressure changes, and a non-focused probing wave to measure propagation speed (Col. 10 lines 8-12). Sato does not teach, disclose, or suggest transmitting a first and second focused ultrasound energy beams to induce vibration of a desired region, and transmitting a third focused ultrasound energy beam from a third source into the desired region, receiving echo signals from the desired region indicative of reflected energy from the third source, and analyzing the vibration of the desired region indicated by the received signals. The Examiner suggests that the combination of Greenleaf and Ehman can viewed as an invitation to use an imager to recover information from the vibration-inducing beams discussed in Sato and Shimura (Office Action, page 9). Applicants respectfully assert, however, that neither Sato nor Shimura teach, disclose, or suggest imaging a focused vibration. Applicants assert that the combination of Greenleaf and Ehman further in view of Sato and Shimura does not suggest transmitting a first and a second focused ultrasound energy beams from a first and a second sources into an object such that the focused ultrasound beams intersect at a desired region to induce vibration of the desired region by providing a pushing force to the desired region, as recited in claim 1, a system including first, second, and third transducers configured to convert electrical signals into focused ultrasound energy and to transmit the focused ultrasound energy to a desired region to induce a pushing force on the desired region, as recited in claim 8, or, a system including a first and a second ultrasound transducers configured to convert electrical signals into focused ultrasound energy and to transmit the focused ultrasound energy to provide a pushing force to induce vibration of the desired region, as recited in claim 14. Thus these claims, and their dependent claims, are patentable over Greenleaf and Ehman in view of Sato and Shimura.

Claims 1-19 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,606,971 (Sarvazyan) and U.S. Patent No. 5,810,731 (Sarvazyan et al., CIP of Sarvazyan) patents. Applicants respectfully assert that these claims are patentable over Sarvazyan and Sarvazyan et al. because Sarvazyan and Sarvazyan et al. teach away from claims 1-19.

Sarvazyan does not teach, disclose or suggest vibrations that result from the pushing force created by two focused ultrasound beams. Sarvazyan discusses a method of shear wave generation by a radiation force of focused energy such as ultrasound from an ultrasound transducer (Col. 2 lines 35-37). In Sarvazyan, a pulsed ultrasonic beam propagates from a transmitting transducer to a focal region in the tissue where it induces a shear wave corresponding to a modulating signal (Col. 4 lines 8-11). The high attenuation of the shear waves and the resulting shear strain can induce mechanical oscillations within a very limited area of the issue in the vicinity of the focal point of a focused ultrasonic beam (Col. 3 lines 2-5, Col. 5 lines 20-22). In contrast, independent claim 1 recites transmitting first and second focused ultrasound energy beams from first and second sources into an object such that the focused ultrasound beams intersect at a desired region to induce vibration of the desired region by providing a pushing force to the desired region. Independent claim 8 recites a system including first, second, and third transducers configured to convert electrical signals into focused ultrasound energy and to transmit the focused ultrasound energy to a desired region to induce a pushing force on the desired region. Independent claim 14 recites a system including a first and a second ultrasound transducers configured to convert electrical signals into focused ultrasound energy and to transmit the focused ultrasound energy to provide a pushing force to induce vibration of the desired region. Thus, Sarvazyan discusses mechanical oscillations that result from induced shear strain, while independent claims 1, 8 and 14 recite vibrations that result from the pushing force created by two focused ultrasonic beams. For at least these reasons, applicants respectfully assert that independent claims 1, 8 and 14, and claims 2-7, 9-13, and 15-19, that each depend directly or indirectly from independent claims 1, 8 and 14, are patentable over Sarvazyan and Sarvazyan et al.

Claims 3, 10 and 14-19 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Sarvazyan and Sarvazyan et al. in further view of U.S. Patent No. 4,012,950 (Kompfner) or Greenleaf. Applicants respectfully assert that the proposed combination of Sarvazyan,

Sarvazyan et al., and Kompfner is improper, and therefore these claims are patentable over Sarvazyan, Sarvazyan et al., and Kompfner.

The proposed combination of Sarvazyan, Sarvazyan et al., and Kompfner is improper because Sarvazyan and Sarvazyan et al. teach away from the proposed combination. Kompfner discusses a system including two radio frequency generators at different frequencies arranged to generate simultaneous and coincident acoustic beams in a single transducer (Col. 6 lines 63-66). These acoustic beams can be used to excite mechanical and molecular resonances in a substance (Col. 6 lines 57-61). Kompfner does not indicate that the different frequency signals discussed in Kompfner will generate detectable shear waves. In contrast, Sarvazyan discusses a method of shear wave generation by a radiation force of focused energy such as ultrasound from an ultrasound transducer (Col. 2 lines 35-37). Sarvazyan et al. discusses an ultrasonic detector to measure propagation properties of shear waves (Col. 6 lines 6-16). Sarvazyan and Sarvazyan et al. do not teach, disclose or suggest a system including two radio frequency generators because shear wave generation is based on a single monopolar acoustic pulse (Sarvazyan et al. Col. 3 lines 34-41). Sarvazyan and Sarvazyan et al. specifically discuss shear wave generation and detection, and therefore teach away from the forces produced by different frequency waves discussed in Kompfner. The combination of Sarvazyan and Sarvazyan et al. with Kompfner would not work as Sarvazyan and Sarvazyan et al. intended and thus the proposed combination is improper. Thus claims 3, 10, and 14-19 are patentable over Sarvazyan and Sarvazyan et al. in view of Kompfner.

The proposed combination of Sarvazyan, Sarvazyan et al., and Greenleaf is improper because the result of the combination would be inoperative. Greenleaf discusses a system including two transducers driven by continuous wave synthesizers at ultrasound frequencies (Col. 6 lines 5-7). The radiation force produced by the intersecting high frequency sound beams produces motion at the intersect location which can be detected and analyzed to measure the mechanical characteristics at that location (Col. 3 lines 42-45). For reasons similar to the discussion above with respect to Kompfner, the use of Greenleaf with Sarvazyan and Sarvazyan et al. is antithetical to the use of shear waves in Sarvazyan and Sarvazyan et al. and thus is an improper combination. Thus claims 3, 10, and 14-19 are patentable over Sarvazyan and Sarvazyan et al. in view of Greenleaf.

Claim 20 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Sarvazyan and Sarvazyan et al. in further view of Kompfner or Greenleaf, and further in view of U.S. Patent No. 5,984,881 (Ishibashi) or Rolt. Applicants respectfully assert that these claims are patentable over Sarvazyan and Sarvazyan et al. over Kompfner or Greenleaf, in further view of Ishibashi or Rolt. As discussed above, the proposed combination of Sarvazyan, Sarvazyan et al. with either Kompfner or Greenleaf is improper, and the further combination with Ishibashi or Rolt do not cure this. Thus, claim 20 is patentable over Sarvazyan, Sarvazyan et al., over Kompfner or Greenleaf, in further view of Ishibashi or Rolt.

Claims 1-20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Greenleaf as incorporating Ehman and in further view of Sarvazyan and Sarvazyan et al., alone or in further view of Ishibahi or Rolt. Applicants respectfully assert that these claims are patentable over Greenleaf as incorporating Ehman and in further view of Sarvazyan and Sarvazyan et al., alone or in further view of Ishibahi or Rolt. As discussed above, the proposed combination of Sarvazyan, Sarvazyan et al. with Greenleaf is improper, and the further combination with Ishibashi or Rolt do not cure this. Thus claims 1-20 are patentable over Greenleaf as incorporating Ehman and in further view of Sarvazyan and Sarvazyan et al.

Based on the foregoing, this application is believed to be in allowable condition, and a notice to that effect is respectfully requested. The Examiner is invited to call the Applicants' Attorney at the number provided below with any questions.

Respectfully submitted,

Shane H. Hunter, Registration No.41,858
Attorney for Applicants
Mintz, Levin, Cohn, Ferris,
Glovsky and Popeo, P.C.
One Financial Center
Boston, Massachusetts 02111
Telephone: (617) 542-5000
Facsimile: (617) 542-2241
Customer No. 30623

Date: March 21, 2005

TRA 1998837v2